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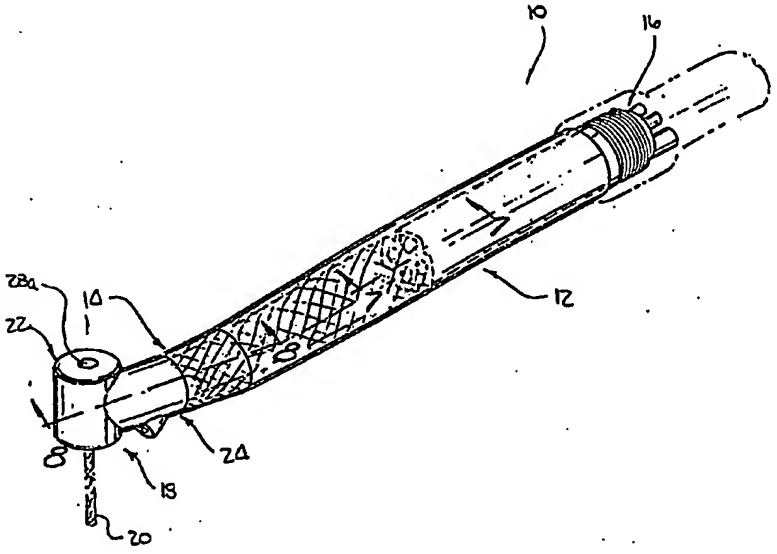


(57) Abstract

A disposable dental handpiece (10) comprising a main housing member (12) and a head member (18) attached to one end (14) of the main housing member (12) which is sized and configured to accommodate the rotatable drive means for a dental tool (20). The main housing and head members (12, 18) are formed from an autoclavable plastic material for permitting a limited number of sterilizations and reuses of the dental handpiece (10) prior to the disposal thereof.

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# DISPOSABLE DENTAL HANDPIECE

## Field of the Invention

The present invention relates generally to disposable dental handpieces, and more particularly, to an autoclavable dental handpiece which is adapted to undergo a limited number of sterilizations and re-uses prior to the disposal thereof.

## Background of the Invention

One of the most common pieces of equipment found in a dentist's office is a dental handpiece which is typically utilized to conduct drilling, grinding and cleaning procedures. The prior art dental handpieces are primarily fabricated from stainless steel and include dental tool drive components disposed therewithin which are either pneumatically or electrically powered. Since the dental handpiece, and in particular the tool receiving and holding portion thereof, is often exposed to saliva and/or blood from the patient during the performance of one of the aforementioned procedures, the handpiece must be sterilized after each use to prevent the risk of disease transmission from one patient to another. Such sterilization is typically conducted through the utilization of an autoclave which subjects the dental handpiece to super heated steam under pressure. However, such repeated sterilization is both inconvenient and expensive.

Due to the growing concerns of many patients and dental practitioners about the potential for disease transmission from traditional dental handpieces, there has been developed in the prior art various types of disposable dental handpieces which are adapted for use on one patient only, and then disposed of in a proper fashion. The use of these disposable dental handpieces has been found to be desirable since the portions that come into contact with the patient may be thrown away after use, thereby eliminating the time, expense and inconvenience of sterilizing the handpiece and also

eliminating the risk of incomplete sterilization and/or cross-contamination and transfer of infection, thus providing the patient with the assurance of safety and protection. Examples of disposable handpieces are found in United States Letters Patent Nos. 3,727,313 (Graham); 5,007,832 (Meller, et al.); and 5,160,263 (Meller, et al.).

Though disposable dental handpieces present certain advantages over the traditional stainless steel handpieces, the disposable handpieces themselves possess certain deficiencies which detract from their overall utility. In certain prior art disposable handpieces, all the internal parts thereof are made of disposable plastic material, thus resulting in the device providing poor operability. Additionally, the disposable dental handpieces which are adapted to be used only once are themselves costly, and therefore significantly increase the cost of the dental procedure with such expense being passed on to the patient. Further, the materials utilized to fabricate these disposable dental handpieces are not adapted to withstand autoclaving, thus preventing the sterilization and re-use of the handpiece on the same patient.

The present invention addresses the risks of incomplete sterilization and disease transmission, as well as the undesirability of increased dental treatment costs, by providing a disposable dental handpiece which is formed from an autoclavable plastic material, thus permitting a limited number of sterilizations and re-uses thereof prior to disposal. Advantageously, each patient may be provided with his or her own dental handpiece during an initial visit with the dental practitioner, with the patient keeping the handpiece after the procedure and bringing the handpiece back to the practitioner during each subsequent visit. After each visit, the dental handpiece is sterilized in an autoclave prior to being returned to the patient, or stored within

the patient's file. Since the handpiece may be sterilized, the expense associated therewith is only incurred by the patient upon the initial visit, and not upon each subsequent visit. This is in marked contrast to the use of conventional disposal dental handpieces, wherein the patient must pay for a new handpiece upon each visit. Additionally, since each patient has his or her own re-usable handpiece, the risk of disease transmission is eliminated even in the event of incomplete sterilization of the handpiece. The handpiece of the present invention may be autoclaved and re-used 20 to 30 times prior to having to replace the same, thus minimizing the cost to the patient.

## Summary of the Invention

In accordance with a preferred embodiment of the present invention there is provided a disposable dental handpiece comprising a main housing member defining first and second ends and a head member attached to the first end of the main housing member. The head member is sized and configured to accommodate a rotatable drive means for a dental tool, and preferably includes a pneumatically driven rotatable drive means disposed therein. Both the main housing and head members of the handpiece are formed from an autoclavable plastic material for permitting a limited number of sterilizations and re-uses of the dental handpiece prior to the disposal thereof.

In the preferred embodiment, the rotatable drive means comprises a pair of bearing members which are disposed within the head member in coaxial, spaced relation. Disposed between the bearing members is a turbine member which defines a plurality of turbine blades extending radially therefrom. Extending axially through and engaged to the bearing members and the turbine member is a tubular bushing. Disposed within and threadably engaged to the bushing is a collet member which is adapted to receive a dental tool. In operation, the impingement of pressurized air against the turbine

blades facilitates the rotation of the turbine member between the bearing members, and the concurrent rotation of the bushing and collet, thus facilitating the rotation of the dental tool.

The main housing member of the dental handpiece itself comprises a handle member which defines a first bore disposed within the first end thereof, and a second bore disposed within the second end thereof. Partially inserted into the second bore of the handle member is an elongate adapter member, with the head member of the handpiece being partially inserted into the first bore. The adapter member defines a first set of passages extending longitudinally therethrough, with the handle member defining a second set of passages extending between the first and second bores thereof, each of which are placed into fluid communication with a respective one of the passages of the first set when the adapter member is inserted into the second bore. The head member defines a third set of passages, with at least two of the passages terminating at the drive means disposed therewithin, and the remaining passages extending through the head member. Each of the passages of the third set are placed into fluid communication with a respective one of the passages of the second set when the head member is inserted into the first bore.

The adapter member is releasably couplable to pressurized air and water sources for allowing air and water to be dispensed from the head member after flowing through the handpiece via selected passages of the first, second and third sets which are in communication with each other. The air and water and preferably mixed within the adapter member such that the head member dispenses an air/water mixture rather than independent air and water streams. The two passages of the third set terminating within the head member at the drive means comprise air inlet and exhaust passages for pneumatically driving the drive means with air from the air source

which flows through the handpiece via the inlet and outlet passages and selected passages of the first and second sets which are in communication with the inlet and outlet passages and each other. Additionally, the adapter member is releasably couplable to a light source for allowing light to be directed out of the head member after being transmitted through the handpiece via an optical fiber extending through selected passages of the first, second and third sets which are in communication with each other.

In the preferred embodiment, the head member itself is fabricated from two identically configured head member halves. Additionally, a portion of the head member and the first bore are preferably formed having complimentary configurations for preventing rotation of the head member within the first bore when inserted thereinto. Similarly, a portion of the adapter member and the second bore are preferably formed having complimentary configurations which are adapted to prevent rotation of the adapter member within the second bore when inserted thereinto.

## Brief Description of the Drawings

These, as well as other features of the present invention, will become more apparent upon reference to the drawings wherein:

Figure 1 is a front perspective view of the dental handpiece constructed in accordance with the present invention;

Figure 2 is an exploded view illustrating the components comprising the drive means disposed within the head member of the handpiece;

Figure 3 is a front perspective view of the head, handle and adapter members of the handpiece;

Figure 4 is a rear perspective view of the head, handle and adapter members of the handpiece;

Figure 5 is a cross-sectional view taken along line 5-5 of Figure 4;

Figure 6 is a cross-sectional view taken along line 6-6 of Figure 5;

Figure 7 is a cross-sectional view taken along line 7-7 of Figure 1;

Figure 8 is a cross-sectional view taken along line 8-8 of Figure 1;

Figure 9 is a cross-sectional view taken along line 9-9 of Figure 8;

Figure 10 is a cross-sectional view taken along line 10-10 of Figure 8; and

Figure 11 is a rear perspective view illustrating the two halves of the head member of the handpiece.

**Detailed Description of the Preferred Embodiment**

Referring now to the drawings wherein the showings are for purposes of illustrating a preferred embodiment of the present invention only, and not for purposes of limiting the same, Figure 1 perspectively illustrates the dental handpiece 10 constructed in accordance with the preferred embodiment of the present invention. The handpiece 10 generally comprises a main housing member 12 defining a first end 14 and a second end 16. Attached to the first end 14 of the main housing member 12 is a head member 18 which is adapted to receive and rotate a dental tool 20 as will be described below. Importantly, the main housing member 12 and head member 18 are formed from an autoclavable plastic material for permitting a limited number of sterilizations and re-uses of the handpiece 10 prior to the disposal thereof. The advantages attendant to such sterilization and re-use of the handpiece 10 will also be discussed below.

Referring now to Figures 2, 8 and 11, the head member 18 is preferably fabricated from two (2) identically configured head member halves 18a, 18b. When the halves 18a, 18b are attached to each other, the head member 18 defines a cylindrically configured frontal portion 22, a central portion 24 and a rear portion 26. The frontal portion 22 itself defines circularly

configured top and bottom walls 28, 30 and a cylindrically configured interior chamber 32. Disposed within the top wall 28 is an aperture 28a, while disposed within the bottom wall 30 is an aperture 30a which is coaxially aligned with the aperture 28a. Extending radially inward from the side wall 34 of the interior chamber 32 in spaced relation are annularly configured upper and lower flanges 36, 38. As seen in Figure 8, the distance separating the upper flange 36 from the top wall 28 is equal to the distance separating the lower flange 38 from the bottom wall 30, with the top wall 28 and upper flange 36 defining an upper groove 40 therebetween and the bottom wall 30 and lower flange 38 defining a lower groove 42 therebetween.

The head member 18, and more particularly the frontal portion 22 thereof, is sized and configured to accommodate a rotatable drive assembly for the dental tool 20. In the preferred embodiment, the drive assembly is pneumatically driven and is disposed within the interior chamber 32 of the frontal portion 22. As seen in Figures 2 and 8, the rotatable drive assembly comprises a pair of identically configured bearing members 44, each of which includes a central aperture 46 extending axially therethrough. The bearing members 44 are disposed within the interior chamber 32 in coaxial, spaced relation, with the upper bearing member 44 of the pair being abutted against an annular shoulder 29 formed within the top wall 28 and partially extended through the upper flange 36, and the lower bearing member 44 of the pair being abutted against an annular shoulder 31 formed within the bottom wall 30 and partially extended through the lower flange 38. Disposed between the bearing members 44 is a turbine member 48 which defines a central aperture 50 and a plurality of radially extending turbine blades 52. Each of the turbine blades 52 defines an angled rear face 54 and a front face including a pair of arcuately contoured grooves 56 formed therein. The

turbine member 48 is compressed between the bearing members 44 such that the central apertures 46, 50 are in coaxial alignment and the turbine blades 52 extend into the portion of the interior chamber 32 defined between the upper and lower flanges 36, 38. The turbine member 48 and bearing members 44 are positioned within the interior chamber 32 such that the central apertures 46, 50, in addition to being coaxially aligned with each other, are in coaxial alignment with the apertures 28a, 30a of the top and bottom walls 28, 30.

Extending axially through the aligned central apertures 46, 50 of the bearing members 44 and turbine member 48 is an elongate, tubular bushing 58. In the preferred embodiment, the diameters of the central apertures 46, 50 are approximately equal, with the outer diameter of the bushing 58 slightly exceeding the diameters of the central apertures 46, 50. As such, the bushing 58 is press fit into the central apertures 46, 50 thus facilitating the rigid engagement thereof to the bearing members 44 and turbine member 48. The bushing 58 itself defines a top end 58a and a bottom end 58b. Extending longitudinally through the bushing 58 is a central bore 60, the upper portion of which is internally threaded. As seen in Figure 8, the bushing 58 is extended into and through the central apertures 46, 50 such that the top end 58a thereof is substantially flush with the outer surface of the upper bearing member 44 which is abutted against the annular shoulder 29 formed within the top wall 28. As such, a slight gap exists between the top end 58a of the bushing 58 and the inner surface of top wall 28, with the central bore 60 being in coaxial alignment with the aperture 28a of the top wall 28. The bottom end 58b of the bushing 58 extends axially beyond the outer surface of the lower bearing member 44 which is abutted against the annular shoulder 31, and through the aperture 30a disposed within the bottom wall 30.

Disposed within the central bore 60 of the bushing 58 is an elongate collet member 62 defining a top end 62a having a square key-way 64 formed therein, and a tapered bottom end 62b. The collet member 64 further defines an externally threaded upper portion 66, and an opposed pair of slots 68 which extend longitudinally from the bottom end 62b through the lower portion of the collet member 62. As seen in Figure 8, the bottom end 62b of the collet member 62 is inserted into the top end 58a of the bushing 58, with the externally threaded upper portion 66 thereof being threadably engaged to the internally threaded upper portion of the central bore 60. When the collet member 62 is threadably engaged to the bushing 58, the tapered bottom end 62b is abutted against a beveled surface 70 extending about the inner surface of the central bore 60 immediately adjacent the bottom end 58b of the bushing 58.

The attachment of the dental tool 20 to the handpiece 10 is facilitated by the insertion of the shank portion thereof into the bottom end 62b of the collet member 62. Thereafter, a tightening tool (not shown) is extended through the aperture 28a and into the key-way 64 disposed within the top end 62a of the collet member 62. The rotation of the tightening tool in a clockwise direction facilitates the downward travel of the collet member 62 within the central bore 60, which in turn forces the tapered bottom end 62b of the collet member 62 against the beveled surface 70 of the bushing 58. Due to the contact between the tapered bottom end 62b and the beveled surface 70, the downward movement of the collet member 62 causes the juxtaposed lower portions thereof defined by the slots 68 to be compressed toward each other and against the shank of the dental tool 20, thus firmly maintaining the dental tool 20 within the collet member 62. Conversely, the counter-clockwise rotation of the tightening tool facilitates the upward travel of the collet member 62 within the central bore 60 which causes

the bottom end 62b to move out of contact with the beveled surface 70 and the juxtaposed lower portions of the collet member 62 to flex away from each other, thus allowing the shank portion of the dental tool 20 to be slidably removed from within the collet member 62.

In addition to the foregoing components, the drive assembly further comprises a pair of O-rings 72 which are disposed within the upper and lower grooves 40, 42 defined within the interior chamber 32. Each of the O-rings 72 forms a fluid-tight seal between the side wall 34 of the interior chamber 32 and a respective one of the bearing members 44 for reasons which will be discussed below.

In the preferred embodiment of the present invention, the components comprising the drive assembly are engaged to each other prior to the placement of the drive assembly into the interior chamber 32 of the head member 18. In particular, the turbine member 48 is initially disposed between the bearing members 44, with the bushing 58 subsequently being extended through the coaxially aligned central apertures 46, 50 thereof in the aforementioned manner. The collet member 62 is then inserted into the central bore 60 of the bushing 58, with the threaded upper portion 66 thereof being threadably engaged to the internally threaded upper portion of the central bore 60. The O-rings 72 are then extended over the outer surfaces of respective ones of the bearing members 44. Thereafter, the drive assembly is placed into one of the head members halves 18a, 18b. Importantly, the length of the interior chamber 32 (i.e., the distance separating the inner surfaces of the top and bottom walls 28, 30 from each other) is sized relative to the drive assembly such that when the drive assembly is positioned therewithin, the O-rings 72 will reside within the upper and lower grooves 40 and 42, the outer surfaces of the bearing members 44 will be abutted against the annular shoulders 29, 31, the turbine blades 52 will

extend between the upper and lower flanges 36, 38, and the lower portion of the bushing 58 will reside within the aperture 30a. After the drive assembly has been placed within one of the head member halves 18a, 18b, the remaining half is sonically welded to the first half, thus capturing the drive assembly within the interior chamber 32.

As best seen in Figures 2, 8 and 11, formed within the first half 18a of the head member 18 is an elongate air exhaust passage 74 which extends longitudinally through the rear and central portions 26, 24 and communicates with the interior chamber 32 via an opening disposed within the side wall 34 between the upper and lower flanges 36, 38. Additionally, disposed within the head member half 18b is an air inlet passage 76 which extends longitudinally through the rear and central portions 26, 24 and also communicates with the interior chamber 32 via an opening disposed within the side wall 34 between the upper and lower flanges 36, 38. Also formed within the head member halves 18a, 18b are air/water passage halves 78a, 78b and fiber optic passage halves 80a, 80b. When the head member halves 18a, 18b are attached to each other, the passage halves 78a, 78b form an air/water passage 78, with the passage halves 80a, 80b forming a fiber optic passage 80. Additionally, the rear portion 26 of the head member 18 is formed having a generally cross-shaped configuration including four (4) cut-out regions 82 spaced equidistantly about the periphery thereof.

The air/water passage 78 of the head member 18 extends longitudinally through the rear portion 26, and then bends sharply so as to extend through the central portion 24 at an angle of approximately 150 degrees relative the axis of the longitudinally extending portion thereof. The angled portion of the air/water passage 78 terminates into a reduced diameter outlet opening 79 disposed within the outer surface of the central portion

24. As will be described in more detail below, the bent configuration of the air/water passage 78 allows an air/water stream AW exiting the passage 78 via the outlet opening 79 thereof to directly impinge the cutting region of the dental tool 20. Similarly, the fiber optic passage 80 extends longitudinally through the rear portion 26, and then bends sharply so as to extend through an enlargement 84 formed on the underside of the central portion 24 at an angle of approximately 145 degrees relative the axis of the longitudinally extending portion thereof. The angled region of the fiber optic passage 80 extending through the enlargement 84 is of a reduced diameter and facilitates the transmission of a light beam L to the cutting region of the dental tool 20.

In the preferred embodiment, the main housing member 12 of the handpiece 10 itself comprises an elongate handle member 86 defining a first end 86a and a second end 86b. The handle member 86 is formed having a slight bend therewithin thus causing a portion of the handle member 86 adjacent the first end 86a to be angularly offset from the remainder of the handle member 86. Disposed within the first end 86a is a first bore 88 which extends longitudinally through the angled portion of the handle member 86, while disposed within the second end 86b is a second bore 90 which extends longitudinally to approximately the mid-point of the handle member 86. In addition to the handle member 86, the main housing member 12 comprises an elongate adapter member 92 which itself defines a connector portion 94 and a slide portion 96. Like the rear portion 26 of the head member 18, the slide portion 96 of the adapter member 92 has a cross-shaped configuration including four (4) cutout regions 98 equidistantly spaced about the periphery thereof.

As best seen in Figures 3 and 4, the first bore 88 of the handle member 86 has a cross-shaped configuration which is complimentary to the configuration of the rear portion 26 of the head member 18 and sized to slidably

receive the rear portion 26 therewithin. The second bore 90 also has a cross-shaped configuration which is complimentary to the configuration of the slide portion 96 of the adapter member 92 and sized to slidably receive the slide portion 96 therewithin. When the rear portion 96 of the head member 18 is fully received into the first bore 88, the shoulder 100 defined between the central and rear portions 24, 26 is abutted against the first end 86a of the handle member 86. Additionally, when the adapter member 92 is fully received into the second bore 90, a shoulder 102 defined between the connector and slide portions 94, 96 is abutted against the second end 86b of the handle member 86. As such, when the adapter member 92 is fully received into the second bore 90, the connector portion 94 thereof defines the second end 16 of the main housing member 12. As will be recognized, the receipt of the cross-shaped rear and slide portions 26, 96 into the complimentary first and second bores 88, 90 prevents the rotation of the head and adapter members 18, 92 therewithin, and maintains a desired registry between the head and adapter members 18, 92 and the handle member 86 for reasons which will hereinafter be discussed.

Referring now to Figures 4 and 9, extending longitudinally through the handle member 86 between the first and second bores 88, 90 thereof is an air exhaust passage 104, an air inlet passage 106, an air/water passage 108 and a fiber optic passage 110. As seen in Figure 8, due to the portion of the handle member 86 adjacent the first end 86a thereof being angularly offset relative the remainder of the handle member 86, the air exhaust and inlet passages 104, 106 extend at a slight angle relative the axis of the first bore 88. The air/water passage 108, which has a generally V-shaped configuration throughout a substantial portion of the length thereof, communicates with the first bore 88 via a reduced diameter outlet 112 which is also angularly offset from the axis of the first bore 88. The fiber

optic passage 110 is bent within the handle member 86 adjacent the first bore 88, with the angle defined by the fiber optic passage 110 being substantially equal to the angle defined by the portion of the handle member 86 adjacent the first end 86a thereof relative the remainder of the handle member 86. As such, the portion of the fiber optic passage 110 terminating into the first bore 88 extends in substantially parallel relation to the axis thereof.

Referring now to Figure 3-7, extending longitudinally through the adapter member 92 is an air exhaust passage 114 which defines an exhaust port 116 on the connector portion 94 of the adapter member 92, and an air inlet passage 118 which defines an inlet port 120 on the connector portion 94. Also extending longitudinally through the adapter member 92 is an air/water passage 122 which defines an air inlet port 124 and a water inlet port 126 on the connector portion 94, and a fiber optic passage 128. As best seen in Figures 1 and 3, the adapter member 92, and in particular the connector portion 94 thereof, is adapted to be releasably couplable to an air, water and light source 130. The source 130 itself defines a first port 132 sized to slidably receive the exhaust port 116, a second port 134 sized to slidably receive the inlet port 120, a third port 136 sized to slidably receive the air inlet port 134, a fourth port 138 sized to slidably receive the water inlet port 126 and a fifth port 140 which is adapted to be in coaxial alignment with the fiber optic passage 128 when the inlet and exhaust ports 116, 120, 124, 126 are received into the ports 132, 134, 136, 138. When the source 130 is coupled to the adapter member 92 in the aforementioned manner, the attachment therebetween is maintained via the threaded engagement of a rotatable bonnet 142 of the source 130 to the threaded outer surface of the connector portion 94. Like the air/water passage 108 extending through the handle member 86, the air/water passage 122

extending through the adapter member 92 has a generally V-shaped configuration throughout a substantial portion of the length thereof. Importantly, separate air and water streams are initially introduced into the air/water passage 122 via the air and water inlet ports 124, 126, with the air and water being immediately mixed so as to form an air/water vapor stream which passes through the handpiece 10, as will be discussed in more detail below.

As seen in Figures 1, 3 and 8, when the rear portion 26 of the head member 18 is fully inserted into the first bore 88 (i.e., the shoulder 100 is abutted against the first end 86a), the air/water passage 78 of the head member 18 is placed into fluid communication with the outlet 112 of the air/water passage 108 of the handle member 86. In the preferred embodiment, the diameter of the air/water passage 78 is substantially identical to the diameter of the outlet 112, and in direct alignment therewith when the rear portion 26 is fully received into the first bore 88. In addition to the air/water passage 78 being aligned and in fluid communication with the outlet 112, the air exhaust passage 74 is aligned and placed into fluid communication with the air exhaust passage 104, with the air inlet passage 76 being aligned and placed into fluid communication with the air inlet passage 106. Further, the fiber optic passage 80 of the head member 18 is aligned and placed into communication with the fiber optic passage 110 of the handle member 86.

As best seen in Figures 4 and 7, when the slide portion 96 of the adapter member 92 is fully received into the second bore 90 (i.e., the shoulder 102 is abutted against the second end 86b), the V-shaped air/water passage 122 of the adapter member 92 is aligned and placed into fluid communication with the V-shaped air/water passage 108 of the handle member 86. Additionally, the air exhaust and inlet passages 114, 118 of the adapter member 92 are aligned and placed into fluid communication with the air exhaust and inlet

passages 104, 106 of the handle member 86, respectively. Further, the fiber optic passage 128 of the adapter member 92 is aligned and placed into communication with the fiber optic passage 110 of the handle member 86.

Advantageously, the formation of the rear portion 26 of the head member 18 and first bore 88 of the handle member 86 with complimentary cross-shaped configurations facilitates the immediate alignment of the various passages extending through the head member 18 with corresponding passages extending through the handle member 86 when the rear portion 26 is properly inserted into the first bore 88. Similarly, the formation of the slide portion 96 of the adapter member 92 and second bore 90 of the handle member 86 with complimentary cross-shaped configurations facilitates the immediate alignment of the various passages extending through the adapter member 92 with corresponding passages extending through the handle member 86 when the slide portion 96 is properly inserted into the second bore 90. Additionally, the formation of the rear and slide portions 26, 96 and first and second bores 88, 90 with the complimentary cross-shaped configurations prevents any subsequent rotation of the head and/or adapter members 18, 92 relative the handle member 86, which in turn prevents any misalignment between the corresponding passages extending through the head, handle and adapter members 18, 86, 92 from occurring.

As best seen in Figures 7, 8 and 10, once the head, handle and adapter members 18, 86, 92 have been attached to each other in the aforementioned manner, an optical fiber 144 is extended into the fiber optic passage 128 via the entrance thereto disposed in the connector portion 94. The optical fiber 144 is then extended through the fiber optic passage 110 of the handle member 86 and into the fiber optic passage 80 of the head member 18. When properly positioned within the handpiece 10, one end of the optical fiber 144 terminates at the

entrance to the fiber optic passage 128 disposed within the connector portion 94, with the other end terminating within the reduced diameter, angled region of the fiber optic passage 80 immediately adjacent the outer surface of the enlargement 84. In particular, the outer sheath of the optical fiber 144 preferably terminates within the longitudinally extending portion of the fiber optic passage 80, with only the optical fiber filaments themselves extending to the outer surface of the enlargement 84. The distal ends of the optical fiber filaments are preferably covered by a lens which is disposed within the passage 80 and substantially flush with the outer surface of the enlargement 84. Though not shown, the fifth port 140 of the source 130 includes a light transmitting component disposed therein immediately adjacent the open end thereof. As such, when the source 130 is releasably coupled to the connector portion 94 of the adapter member 92 in the aforementioned manner, the resultant coaxial alignment of the fiber optic passage 128 with the fifth port 140 facilitates the transmission of light from the light transmitting component into and through the optical fiber 144 and out of the enlargement 84 in the form of the light beam L.

When the source 130 is coupled to the adapter member 92, the second port 134 is utilized to selectively introduce a pressurized stream of air into the inlet port 120 of the connector portion 94. As will be recognized, the pressurized air, when introduced into the inlet port 120, flows through the air inlet passage 118 of the adapter member 92, the air inlet passage 106 of the handle member 86 and the air inlet passage 76 of the head member 18. As previously specified, the air inlet passage 76 communicates with the interior chamber 32 intermediate the upper and lower flanges 36, 38 formed therewithin. As such, the pressurized air entering the interior chamber 32 via the air inlet passage 76 directly impinges the turbine blades 52, and in particular, the

grooves 56 formed therewithin thus facilitating the rotation of the turbine member 48. The rotation of the turbine member 48 in turn causes the rotation of the bushing 58 and the collet member 62 threadably engaged thereto, thus rotating the dental tool 20 maintained within the collet member 62.

Due to the inclusion of the O-rings 72 within the upper and lower grooves 40, 42 and the seals created between the sidewall 34 and bearing members 44 thereby, pressurized air introduced into the interior chamber 32 is prevented from escaping therefrom via the apertures 28a, 30a disposed in the top and bottom walls 28, 30. As such, subsequent to impinging the turbine blades 52, the pressurized air flows into the air exhaust passage 74 of the head member 18 which also communicates with the interior chamber 32 intermediate the upper and lower flanges 36, 38. The air flows from the air exhaust passage 74 into the air exhaust passage 104 of the handle member 86, and subsequently into the air exhaust passage 114 of the adapter member 92. The air exits the air exhaust passage 114 via the exhaust port 116 and flows into the first port 132 of the source 130. Since the turbine blades extend between the upper and lower flanges 36, 38, the air inlet and exhaust passages 76, 74 communicate with the interior chamber 32 intermediate the upper and lower flanges 36, 38 to facilitate the rotation of the turbine member 48.

In addition to being used to selectively introduce pressurized air into the handpiece 10, the source 130 may also be utilized to selectively introduce an independent stream of pressurized air from the third port 136 thereof into the air/water passage 122 via the air inlet port 124 of the connector portion 94. Concurrently with the introduction of this independent air stream into the air/water passage 122, a water stream is infused from the fourth port 138 of the source 130 into the air/water passage 122 via the water inlet port 126 of the connector

portion 94. As previously specified, the independent air and water streams input into the air and water inlet ports 124, 126 are mixed immediately upon entering the air/water passage 122 of the adapter member 92. The air/water mixture flows from the air/water passage 122 into the air/water passage 108 of the handle member 86 and subsequently into the air/water passage 78 of the head member 18 via the outlet 112. Thereafter, the air/water mixture exits the passage 178 via the outlet opening 79 so as to impinge the cutting region of the dental tool 20 as the air/water stream AW. The air/water passages 122, 108 each have generally V-shaped configurations to facilitate the mixture of the air with the water to create the resultant air/water stream AW which is dispensed from the head member 18. In the preferred embodiment, the head member 18, handle member 86 and adapter member 92 are each fabricated from an autoclavable plastic material for permitting a limited number of sterilizations and re-uses of the handpiece 10 prior to the disposal thereof. As previously explained, each patient is preferably provided with his or her own dental handpiece during initial visit with a dental practitioner, with the patient keeping the handpiece 10 after the procedure and bringing the handpiece 10 back to the practitioner during each subsequent visit. After each visit, the handpiece 10 is sterilized in an autoclave prior to being returned to the patient or suitably stored.

Additional modifications and improvements of the present invention may also be apparent to those skilled in the art. Thus, the particular combination of parts described and illustrated herein is intended to represent only a preferred embodiment of the present invention, and is not intended to serve as limitations of alternative devices within the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A disposable dental handpiece, comprising:

a main housing member defining first and second ends; and

a head member attached to the first end of said main housing member, said head member being sized and configured to accommodate a rotatable drive means for a dental tool;

said main housing and head members being formed from an autoclavable plastic material for permitting a limited number of sterilizations and re-uses of the dental handpiece prior to the disposal thereof.

2. The handpiece of Claim 1 wherein the second end of said main housing member is releasably couplable to pressurized air and water sources and said head member is adapted to dispense air and water.

3. The handpiece of Claim 2 wherein said head member includes a pneumatically driven rotatable drive means disposed therein.

4. The handpiece of Claim 3 wherein said rotatable drive means comprises:

a pair of bearing members disposed within said head member in coaxial, spaced relation;

a turbine member defining a plurality of radially extending turbine blades, said turbine member being disposed between said bearing members;

a tubular bushing extending axially through and engaged to said bearing members and said turbine members; and

a collet member disposed within and threadably engaged to said bushing for receiving said dental tool;

wherein the impingement of pressurized air against said turbine blades facilitates the rotation of said turbine member between said bearing members and the concurrent rotation of said bushing and collet.

5. The handpiece of Claim 3 wherein said main housing member comprises:

a handle member defining first and second ends, a first bore disposed within the first end thereof and a second bore disposed within the second end thereof, said head member being partially insertable into said first bore; and

an elongate adapter member partially insertable into said second bore of said handle member.

6. The handpiece of Claim 5 wherein:

said adapter member defines a first set of passages extending longitudinally therethrough;

said handle member defines a second set of passages extending between said first and second bores, each of the passages of the second set being placed into fluid communication with a respective one of the passages of the first set when the adapter member is inserted into said second bore; and

said head member defines a third set of passages, with at least two of the passages terminating at the drive means and the remaining passages extending through the head member, each of the passages of the third set being placed into fluid communication with a respective one of the passages of the second set when the head member is inserted into said first bore;

said adapter member being releasably couplable to said pressurized air and water sources for allowing air and water to be dispensed from said head member after flowing through said handpiece via selected passages of the first, second and third sets which are in communication with each other.

7. The handpiece of Claim 6 wherein said adapter member is releasably couplable to a light source for allowing light to be directed out of said head member after being transmitted through said hand piece via an optical fiber extending through selected passages of the

first, second and third sets which are in communication with each other.

8. The handpiece of Claim 6 wherein said head member is fabricated from two identically configured head member halves.

9. The handpiece of Claim 6 wherein a portion of said head member and said first bore are formed having complimentary configurations which are adapted to prevent rotation of the head member within the first bore when inserted thereinto, and a portion of said adapter member and said second bore are formed having complimentary configurations which are adapted to prevent rotation of the adapter member within the second bore when inserted thereinto.

10. The handpiece of Claim 6 wherein the two passages of the third set terminating within the head member at the drive means comprise air inlet and exhaust passages for pneumatically driving the drive means with air from said air source which flows through said handpiece via said inlet and outlet passages and selected passages of the first and second sets which are in communication with the inlet and outlet passages and each other.

11. The handpiece of Claim 6 where the air and water are mixed within the adapter member and said head member dispenses an air/water mixture which flows through the handpiece via selected passages of the first, second and third sets which are in communication with each other.

Fig. 1

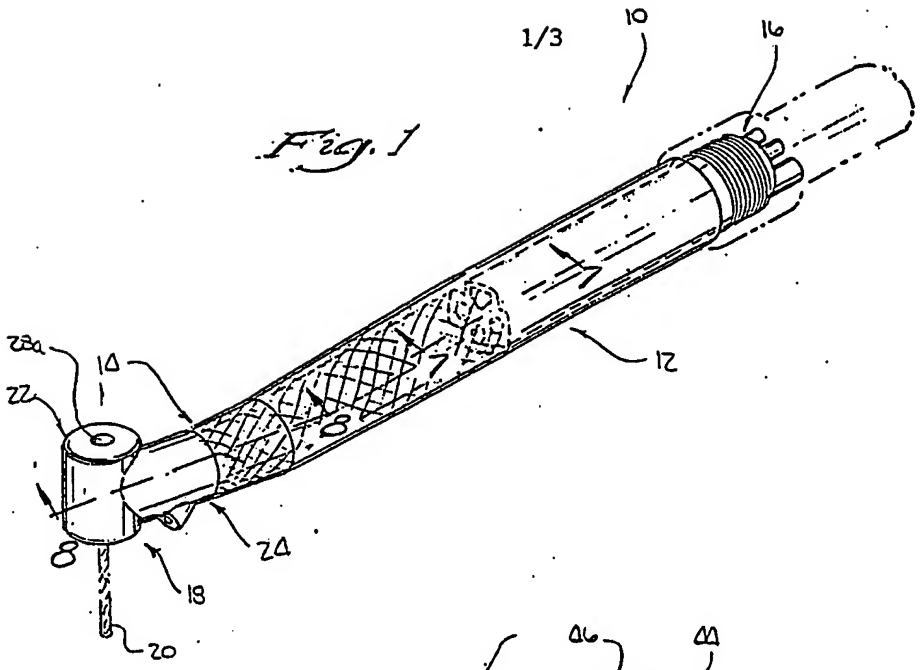
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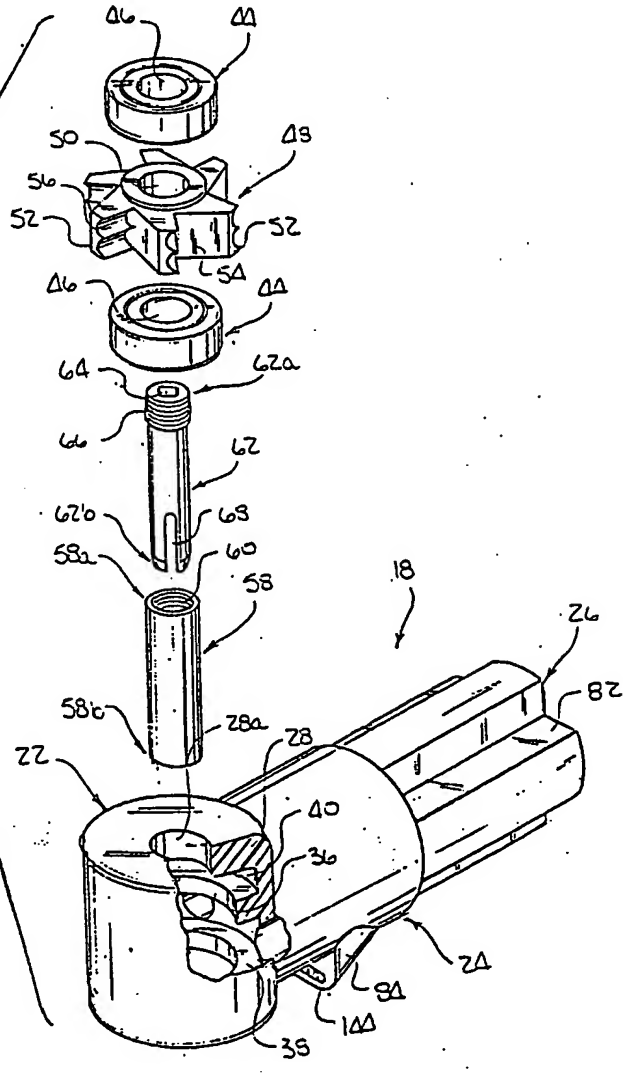
Fig. 2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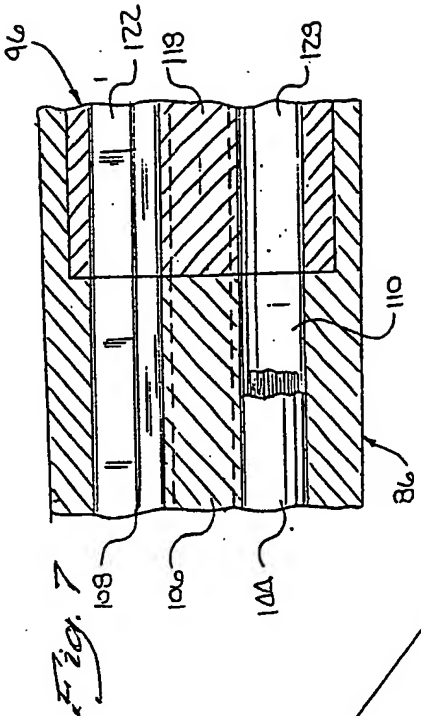

Fig. 7

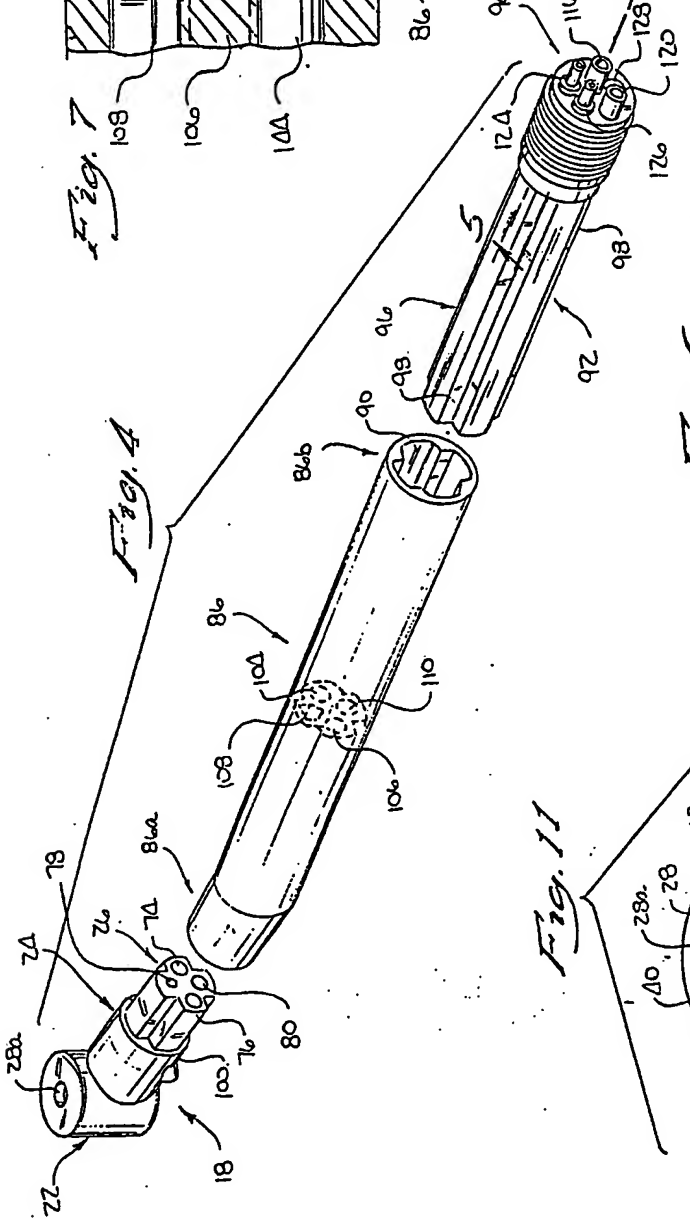

Fig. 4

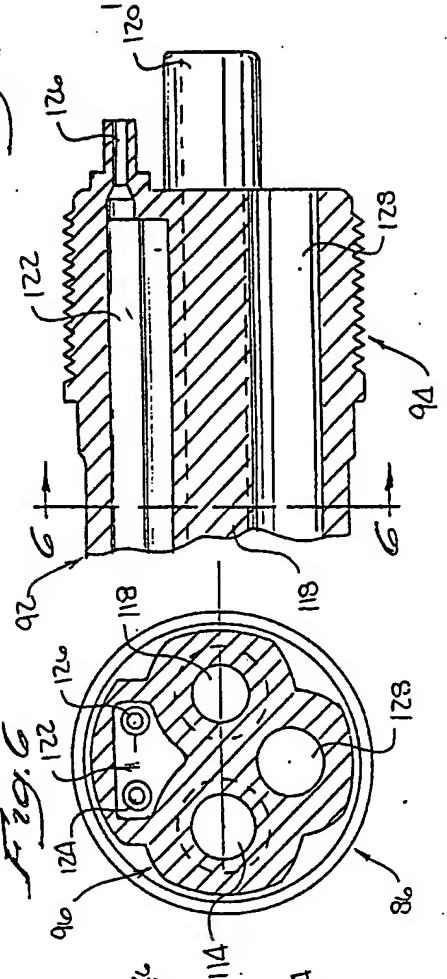

Fig. 5



Fig. 6

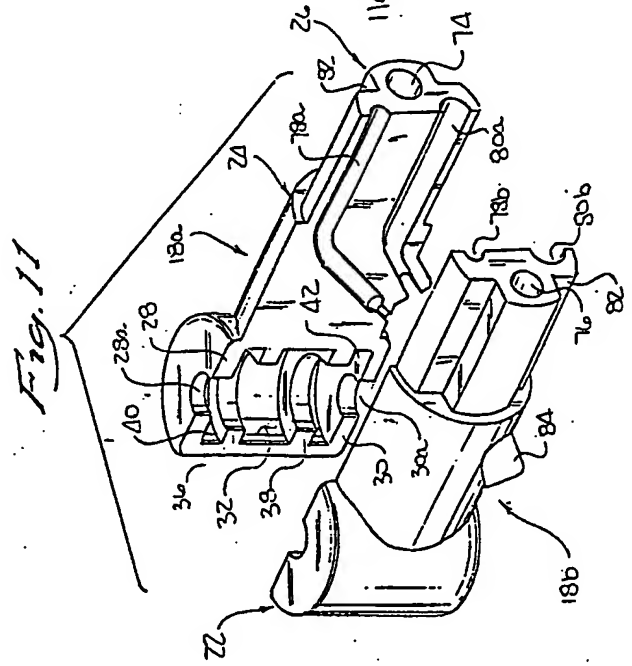

Fig. 11

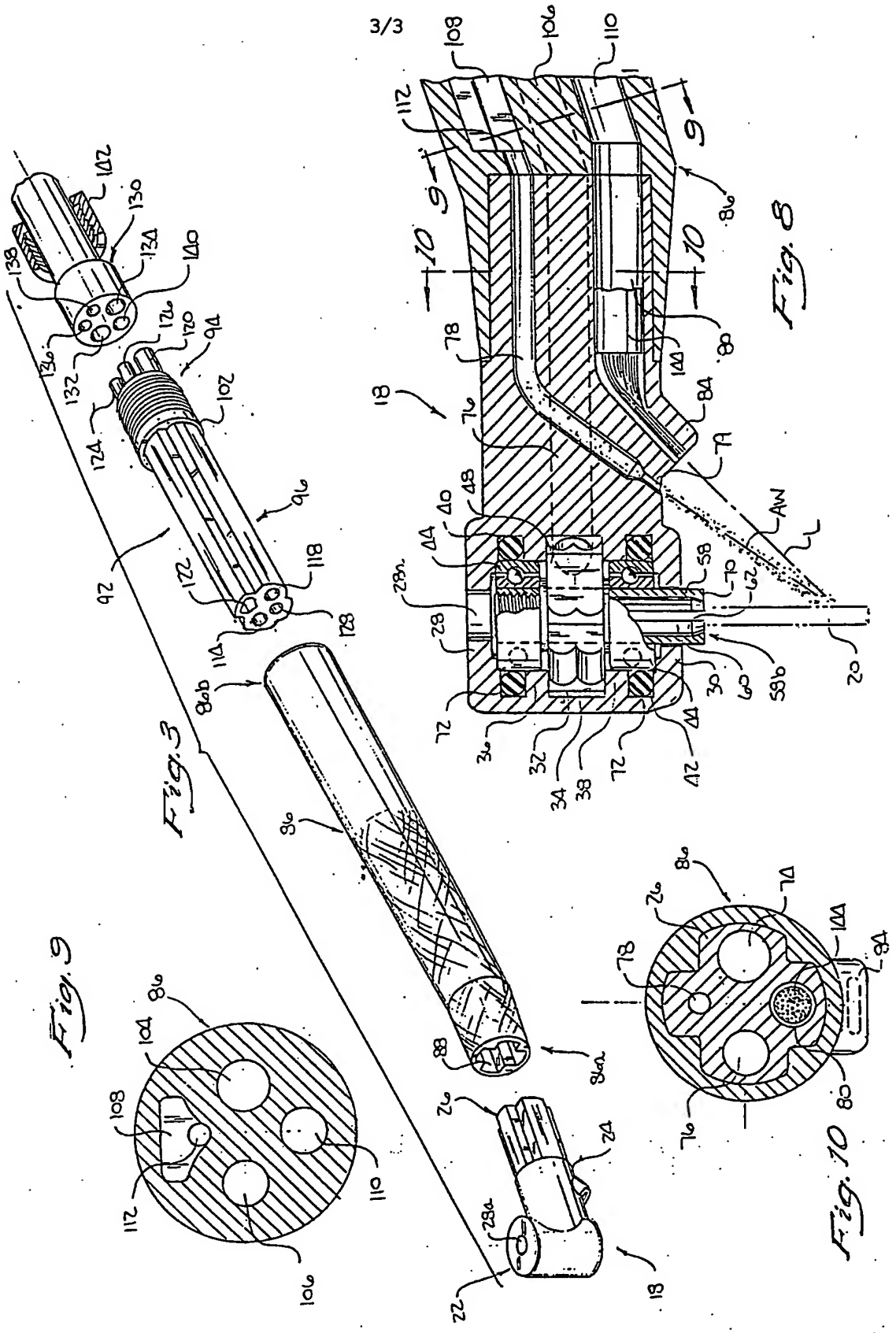
Fig. 8
Fig. 9
Fig. 10

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/12754

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :A61C 1/08
US CL :433/126, 132

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 433/125, 126, 132

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US, A, 5,156,547, (BAILEY), 20 October 1992. See column 3, lines 36-68. | 1 |
| Y, P | US, A, 5,308,242, (MCLAUGHLIN ET AL.), 03 May 1994. See column 4, lines 16-20. | 1-4 |
| Y | WO, A, 9,115,160, (MELLER ET AL.), 17 October 1991. See page 12 lines 6-19, and page 13 lines 22-26. | 1-4 |
| A | US, A, 3,893,242, (LIEB ET AL.), 08 July 1975. See entire document. | 1-11 |
| A | US, A, 5,231,973, (DICKIE), 03 August 1993. See entire document. | 1-11 |
| A | US, A, 5,217,372, (TRUOCCHIO), 08 June 1993. See entire document. | 1-11 |

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

| | | | |
|---|---|---|---|
| * | Special categories of cited documents: | "T" | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "A" | document defining the general state of the art which is not considered to be part of particular relevance | "X" | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| "E" | earlier document published on or after the international filing date | "Y" | document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "L" | document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "&" | document member of the same patent family |
| "O" | document referring to an oral disclosure, use, exhibition or other means | | |
| "P" | document published prior to the international filing date but later than the priority date claimed | | |

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| Date of the actual completion of the international search<br>07 FEBRUARY 1995 | Date of mailing of the international search report<br>13 MAR 1995 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703) 305-3230 | Authorized officer<br>CARY O'CONNOR<br>Telephone No. (703) 308-2701 |

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/12754

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US, A, 3,120,705, (E. HOFFMEISTER ET AL.), 11 February 1964. See entire document. | 1-11 |
| A | US, A, 4,249,896, (KERFOOT, JR.), 10 February 1981. See entire document. | 1-11 |
| A | US, A, 4,941,828, (KIMURA ), 17 July 1990. See entire document. | 1-11 |